Recommended Revisions to Current AHM Protocols

Division of Migratory Bird Management
U.S. Fish & Wildlife Service
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The population models upon which harvest regulations for midcontinent and eastern mallards are based have been in place since 1995 and 2000, respectively. The basic structure of the models, alternative hypotheses of population dynamics, and evidence associated with each hypothesis (i.e., model "weights") are subject to continuous review by parties both internal and external to the AHM process. For the last two years, the AHM Working Group (AHMWG) has been focusing on two especially important concerns about the existing models for midcontinent and eastern mallards, and is recommending certain revisions this year (U.S. Fish and Wildlife Service. 2001. Adaptive harvest management: 2001 duck hunting season. U.S. Dept. Interior, Washington, D.C. 47pp.). These concerns involve the estimates of the reproductive and survival rates used to construct the models, and the procedures used to update model weights.

Nature of the Concerns

Apparent bias in reproductive or survival rates - The current population models for midcontinent and eastern mallards share a common structure referred to as the balance equation. The balance equation is essentially an accounting tool, which predicts population size in a given year based on population size (N), reproduction (R), and survival (S) from the previous year. In theory, N, R, and S from a given year should perfectly predict N the next year. In fact, they do not (Fig. 1). Predicted population sizes are higher on average than those observed in the population surveys. Because the bias appears in several duck stocks (including pintails and western mallards) using different surveys for N, the bias most likely results from the way in which R, S, or both are estimated. The actual source and cause of the bias are unknown, but data-collection programs are now being carefully scrutinized.

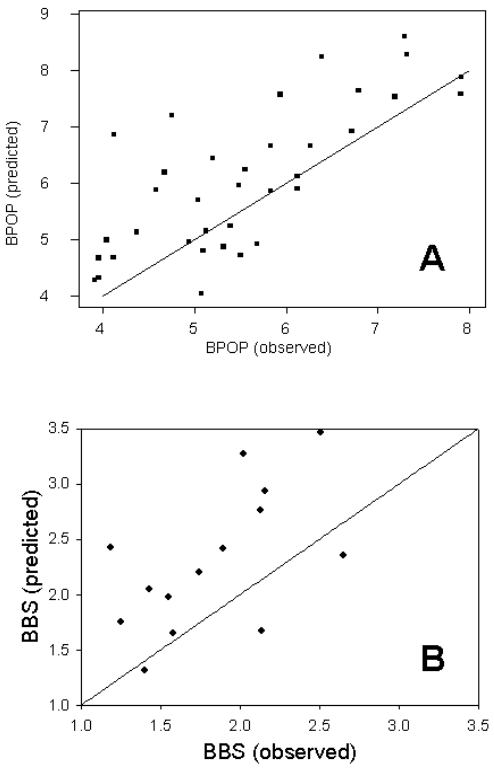

Fig. 1. Predicted versus observed population sizes in: (A) midcontinent mallards based on the breeding-ground survey; and (B) eastern mallards based on the Breeding Bird Survey. The diagonal lines represent perfect agreement between observations and predictions.

There are two important consequences of this bias: (1) predicted growth rates will be too high, suggesting that prescribed hunting regulations could be too liberal under some circumstances; and (2) models that predict the lowest growth rates (e.g., those with additive hunting mortality) will accumulate supporting evidence (i.e., weight), not because they are necessarily "true," but because they help counteract the bias in the balance equation.

Updating model weights.--The purpose of updating model weights in the adaptive setting is to identify the model (hypothesis) providing the most accurate predictions over time, based on a comparison of the observed population sizes with those predicted under each alternative model. The results of the model-weight updating for midcontinent mallards have been

surprising because of the speed with which the process identified the model with additive mortality and strongly density-dependent reproduction as the most appropriate. The identification of this particular model may well be because of the bias in the balance equation discussed above. However, the speed with which model weights changed is probably due to the omission of certain random errors common to all predictive models. The inclusion of these prediction errors in the updating procedure would minimize the chances of major shifts in model weights in any one year. This would help will ensure that model weights change in a way more reflective of the true ability to distinguish between alternative models (hypotheses).

Recommended Revisions and Implications

The AHMWG is recommending that measures designed to address these concerns be implemented for both midcontinent and eastern mallards this year. In the absence of definitive knowledge about the source of bias in the balance equations, the group is recommending an empirical adjustment (i.e., correction factor) to ensure that average predicted and observed populations sizes agree. The harvest-management implications depend, however, on whether the correction is applied to the reproductive or to the survival rates. Therefore, the AHMWG believes that both possibilities need to be recognized explicitly in revised model sets. Also, the AHMWG believes the procedure for updating model weights should be revised to recognize all relevant sources of random error in model predictions, so that the procedure facilitates more reliable learning. The revisions to model weights would be retroactive back to 1995. Unfortunately, the management implications of all these changes will not be fully understood until the AHMWG meets in mid-April.

In the interim, we strongly urge caution in speculating about the regulatory implications of the revisions. Considerable analysis by the AHMWG remains to ensure that the revisions are handled appropriately and that the consequences are verified. Nonetheless, some intuitive comments may be in order. Certainly, a correction for bias in the balance equations is expected to lead to more conservative harvest strategies under all population models. On the other hand, however, revised model weights likely will no longer strongly favor a particular model and, in the case of midcontinent mallards, may well shift the advantage to one or more models that imply more liberal harvest strategies than those associated with the currently favored model. Therefore, it is at least possible that no significant changes in recommended hunting regulations will result from the suggested revisions. If significant changes are implied, we intend to notify the waterfowl management community as soon as we become aware of them.

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